Marked-Up Version of Amendments

Submitted with Amendment; Response to Office Action Mailed June 13, 2002

In the Specification:

On page 38, the paragraph beginning on line 14:

As used herein, "a method of treating a hydrocarbon containing formation" may be used interchangeably with "an in situ conversion process for hydrocarbons." "Hydrocarbons" are generally defined as ~~organic material that contains carbon and hydrogen in their molecular structures~~molecules formed primarily by carbon and hydrogen atoms. Hydrocarbons may also include other elements, such as, but not limited to, halogens, metallic elements, nitrogen, oxygen, and/or sulfur. Hydrocarbons may be, but are not limited to, kerogen, bitumen, pyrobitumen, and oils. Hydrocarbons may be located within or adjacent to mineral matrices within the earth. Matrices may include, but are not limited to, sedimentary rock, sands, silicilytes, carbonates, diatomites, and other porous media.

On page 64, the paragraph beginning on line 11:

As shown in FIG. 3, in addition to heat sources 100, one or more production wells ~~102~~ 104 will typically be disposed within the portion of the coal formation. Formation fluids may be produced through production well 104. ~~Production well 102 may be configured such that a mixture that may include formation fluids may be produced through the production well.~~ Production well ~~102~~ 104 may also include a heat source. In this manner, the formation fluids may be maintained at a selected temperature throughout production, thereby allowing more or all of the formation fluids to be produced as vapors. Therefore high temperature pumping of liquids from the production well may be reduced or substantially eliminated, which in turn decreases production costs. Providing heating at or through the production well tends to: (1) ~~prevent~~ inhibit condensation and/or refluxing of production fluid when such production fluid is moving

in the production well proximate to the overburden, (2) increase heat input into the formation, and/or (3) increase formation permeability at or proximate the production well.

In the Claims:

1727. (amended) A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat from one or more ~~heat sources~~heaters to at least a portion of the formation;

allowing the heat to transfer from the one or more ~~heat sources~~heaters to a ~~selected section~~part of the formation;

wherein the ~~selected section~~part of the formation has been selected for heating using a total organic matter weight percentage of at least a portion of the ~~selected section~~part of the formation, and wherein at least the portion of the ~~selected section~~part of the formation comprises a total organic matter weight percentage~~,~~ of at least about 5.0 %; and

producing a mixture from the formation.

1728. (amended) The method of claim 1727, wherein the one or more ~~heat sources~~heaters comprise at least two ~~heat sources~~heaters, and wherein superposition of heat from at least the two ~~heat sources~~heaters pyrolyzes at least some hydrocarbons within the ~~selected section~~part of the formation.

1729. (amended) The method of claim 1727, further comprising maintaining a temperature within the ~~selected section~~part of the formation within a pyrolysis temperature range from about 270 °C to about 400 °C.

1730. (amended) The method of claim 1727, wherein the one or more ~~heat source~~heaters comprise electrical heaters.

1731. (amended) The method of claim 1727, wherein the one or more ~~heat source~~heaters comprise surface burners.

1732. (amended) The method of claim 1727, wherein the one or more ~~heat source~~heaters comprise flameless distributed combustors.

1733. (amended) The method of claim 1727, wherein the one or more ~~heat source~~heaters comprise natural distributed combustors.

1734. (amended) The method of claim 1727, further comprising controlling a pressure and a temperature within at least a majority of the ~~selected section~~part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

1735. (amended) The method of claim 1727, further comprising controlling the heat such that an average heating rate of the ~~selected section~~part of the formation is less than about 1 °C per day during pyrolysis within a pyrolysis temperature range of about 270 °C to about 400 °C.

1736. (amended) The method of claim 1727, wherein providing heat from the one or more ~~heat source~~heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more ~~heat source~~heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than ~~Pwr, wherein Pwr is calculated by the equation:~~

~~$Pwr = h*V*C_v*\rho_{B_2}$~~

~~wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B~~ is formation bulk density, and wherein ~~the~~ an average heating rate (h) of the selected volume is ~~less than~~ about 10 °C/day.

1738. (amended) The method of claim 1727, wherein providing heat from the one or more ~~heat source~~heaters comprises heating the ~~selected section~~part of the formation such that a thermal

conductivity of at least a portion of the ~~selected section~~part of the formation is greater than about 0.5 W/(m °C).

1750. (amended) The method of claim 1727, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

1753. (amended) The method of claim 1727, further comprising controlling a pressure within at least a majority of the ~~selected section~~part of the formation, wherein the controlled pressure is at least about 2.0 bars absolute.

1758. (amended) The method of claim 1727, further comprising:

providing hydrogen (H_2) to the ~~heated section~~part of the formation to hydrogenate hydrocarbons within the ~~section~~part of the formation; and

heating a portion of the ~~section~~ part of the formation with heat from hydrogenation.

1760. (amended) The method of claim 1727, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the ~~selected section~~part of the formation to greater than about 100 millidarcy.

1761. (amended) The method of claim 1727, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the ~~selected section~~part of the formation.

1763. (amended) The method of claim 1727, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 ~~heat sources~~heaters are disposed in the formation for each production well.

1764. (amended) The method of claim 1727, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, and wherein the unit of ~~heat source~~heaters comprises a triangular pattern.

1765. (amended) The method of claim 1727, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, wherein the unit of ~~heat source~~heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

1766. (amended) A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat from one or more ~~heat sources~~heaters to at least a portion of the formation;

allowing the heat to transfer from the one or more ~~heat sources~~heaters to a ~~selected section~~part of the formation;

wherein at least some hydrocarbons within the ~~selected section~~part of the formation have an initial total organic matter weight percentage of at least about 5.0%; and

producing a mixture from the formation.

1767. (amended) The method of claim 1766, wherein the one or more ~~heat source~~heaters comprise at least two ~~heat source~~heaters, and wherein superposition of heat from at least the two ~~heat source~~heaters pyrolyzes at least some hydrocarbons within the ~~selected section~~part of the formation.

1768. (amended) The method of claim 1766, further comprising maintaining a temperature within the ~~selected section~~part of the formation within a pyrolysis temperature range from about 270 °C to about 400 °C.

1769. (amended) The method of claim 1766, wherein the one or more ~~heat source~~heaters comprise electrical heaters.

1770. (amended) The method of claim 1766, wherein the one or more ~~heat source~~heaters comprise surface burners.

1771. (amended) The method of claim 1766, wherein the one or more ~~heat source~~heaters comprise flameless distributed combustors.

1772. (amended) The method of claim 1766, wherein the one or more ~~heat source~~heaters comprise natural distributed combustors.

1773. (amended) The method of claim 1766, further comprising controlling a pressure and a temperature within at least a majority of the ~~selected section~~part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

1774. (amended) The method of claim 1766, further comprising controlling the heat such that an average heating rate of the ~~selected section~~part of the formation is less than about 1 °C per day during pyrolysis within a pyrolysis temperature range of about 270 °C to about 400 °C.

1775. (amended) The method of claim 1766, wherein providing heat from the one or more ~~heat source~~heaters to at least the portion of the formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more ~~heat source~~heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than ~~Pwr, wherein Pwr is calculated by the equation:~~

~~$Pwr = h*V*C_v*\rho_{B,}$~~

~~wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B~~ is formation bulk density, and wherein ~~the~~ an average heating rate (h) of the selected volume is ~~less than~~ about 10 °C/day.

1777. (amended) The method of claim 1766, wherein providing heat from the one or more ~~heat source~~heaters comprises heating the ~~selected section~~part of the formation such that a thermal conductivity of at least a portion of the ~~selected section~~part of the formation is greater than about 0.5 W/(m °C).

1789. (amended) The method of claim 1766, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

1792. (amended) The method of claim 1766, further comprising controlling a pressure within at least a majority of the ~~selected section~~part of the formation, wherein the controlled pressure is at least about 2.0 bars absolute.

1797. (amended) The method of claim 1766, further comprising:

providing hydrogen (H_2) to the ~~heated section~~part of the formation to hydrogenate hydrocarbons within the ~~section~~part of the formation; and

heating a portion of the ~~section~~ part of the formation with heat from hydrogenation.

1799. (amended) The method of claim 1766, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the ~~selected section~~part of the formation to greater than about 100 millidarcy.

1800. (amended) The method of claim 1766, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the ~~selected section~~part of the formation.

1802. (amended) The method of claim 1766, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 ~~heat sources~~ heaters are disposed in the formation for each production well.

1803. (amended) The method of claim 1766, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, and wherein the unit of ~~heat source~~heaters comprises a triangular pattern.

1804. (amended) The method of claim 1766, further comprising providing heat from three or more ~~heat source~~heaters to at least a portion of the formation, wherein three or more of the ~~heat source~~heaters are located in the formation in a unit of ~~heat source~~heaters, wherein the unit of ~~heat source~~heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

5396. (amended) The method of claim 1763, wherein at least about 20 ~~heat sources~~heaters are disposed in the formation for each production well.

5397. (amended) The method of claim 1802, wherein at least about 20 ~~heat sources~~heaters are disposed in the formation for each production well.